Claims

We claim:

1. A constant speed accessory drive system comprising:

a transmission comprising;

input and output drive members;

radially inner and outer races,

planetary members in rolling contact with said radially inner and outer races,

said inner race and said outer race each comprising two axially spaced parts connected for rotation together and relatively axially moveable,

means for selectively varying the axial separation of said two axially spaced parts of one of said races and thus the radial position of the planetary members in rolling contact therewith comprising an adjustment member and helical interengagement means interconnecting said adjustment member such that relative turning motion of said adjustment member results in relative axial displacement of the adjustment member,

torque sensitive means sensitive to the torque applied between two drive-transmitting members of the transmission, said torque sensitive means acting both to determine the compensating variation in the separation of the parts of the other race and thus the transmission ratio of the transmission and to vary the forces exchanged between the planetary members and the races normal to the interface between them;

a drive motor engaged with a self locking drive comprising a worm gear engaged with the adjustment member and a frictional member engaged with the worm gear;

the self locking drive preventing turning movement of the adjustment member when the drive motor is not energized;

a first endless member connecting a driver and the input drive member;

a first accessory directly connected to a first end of the output drive member; and

a second accessory driven by a second endless member engaged with the output drive member.

2. The system as in claim 1, wherein said other race is the radially inner race, and wherein a part of the radially inner race is carried on a shaft by a second helical interengagement means, and wherein said torque sensitive means for determining the relative separation of the two parts of the radially inner race comprises a biasing member and the second helical interengagement means acting to react the forces exerted by the transmission of drive forces between the radially inner race and the planetary members.

3. The system as in claim 2, wherein said second helical interengagement means reacts a direct circumferential force and an axial force having a circumferential component and said circumferential component of said axial force is substantially equal to and opposite in sign from said direct circumferential force reacted by the second helical interengagement means to minimize the force required to be applied to said control means for selectively varying the axial separation of said two axially spaced parts of said inner race to maintain or change a transmission ratio of said transmission.

4. The system as in claim 2, wherein said second helical interengagement means comprises thread flights that are interengaged by rolling elements.

5. The system in claim 1, wherein the planetary members are substantially spherical and the transmission of forces between the planetary members in planetary motion and one of said input drive member and output drive member is effected via follower members, each follower member comprising a concave form.

6. The system as in claim 1, wherein said torque sensitive means include the two axially spaced, relatively movable parts of the said other race, at lease one of said parts being itself axially movable in two directional senses from a central position and engageable by limit stop means whereby to allow the transmission of rotary drive from the input drive member to the output drive member of the transmission in each of two opposite senses of torque transmission.

7. The system as in claim 6, wherein said relatively movable race parts of the torque-sensitive means are interconnected with the input drive member by a helical engagement, said helical engagement of each of said movable race parts being of the same hand, whereby rotary drive is transmitted when axial displacement of a race part is restrained.

8. The system as in claim 1 wherein the helical interengagement means comprises thread flights that are interengaged by rolling elements.

9. The system as in claim 1 wherein the output means comprises dual coaxial output members.

10. The system as in claim 1, wherein the drive motor comprises a stepper motor.

11. A method of operating a belt drive accessory system comprising the steps of:

transmitting a torque with a first endless member from a driver member to a planetary ball transmission input;

coaxially aligning the planetary ball transmission input with a planetary ball transmission output;

transmitting a torque by a second endless member from the planetary ball transmission output to a driven accessory;

selecting a speed ratio of the planetary ball transmission according to a driver member rotational speed, thereby operating the driven accessory at a substantially constant speed at a point of substantially maximum efficiency over a drive member rotational speed range; and

frictionally locking the speed ratio of the planetary ball transmission when a drive member speed is constant.

12. The method as in claim 11 comprising the step of connecting a driven member directly to a planetary ball transmission second output.

13. The method as in claim 11 comprising the step of tensioning the second endless member with a tensioner.

14. The method as in claim 13 comprising the step of damping an oscillation of the second endless member.

15. The method as in claim 11 comprising the step of tensioning the first endless drive member with a tensioning member.

16. The method as in claim 11 comprising the step of damping an oscillation of the first endless member.

17. The method as in claim 11 comprising the step of a one-way clutching action for a driven accessory overrunning condition.

18. The method as in claim 11 comprising the steps of:

calculating an error between a desired accessory speed and an actual accessory speed; and

adjusting a transmission ratio until no substantial error signal is generated.

19. A transmission comprising:

input and output drive members;

radially inner and outer races;

planetary members in rolling contact with said radially inner and outer races;

said inner race and said outer race each comprising two axially spaced parts connected for rotation together and relatively axially moveable;

means for selectively varying the axial separation of said two axially spaced parts of one of said races and thus the radial position of the planetary members in rolling contact therewith comprising an adjustment member and a helical interengagement member interconnecting said adjustment member such that relative turning motion of said adjustment member results in relative axial displacement of the adjustment member;

a self locking drive comprising a drive motor and a worm gear engaged with the adjustment member and a thrust washer having a frictional coefficient engaged with the worm gear, the self locking drive preventing relative turning motion of the adjustment member when the drive motor is not energized; and

torque sensitive means sensitive to the torque applied between two drive-transmitting members of the transmission comprising a biasing member and a second helical interengagement member acting to react the forces exerted by the transmission of drive forces between the radially inner race and the planetary members, said torque sensitive means acting both to determine the compensating variation in the separation of the parts of the other race and thus the transmission ratio of the device and to vary the forces exchanged between the planetary members and the races normal to the interface between them.

20. The transmission as in claim 19 wherein the planetary members are substantially spherical and the transmission of forces between the planetary members in planetary motion and one of said input drive member and output drive member is effected

via follower members, each follower member comprising a substantially arcuate concave form.

21. The transmission as in claim 19 wherein the output means comprises dual coaxial output members.